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"BIOLOGY AND NUTRITIONAL PROFILE OF FRESH WATER PRAWN *MACROBRACHIUM ROSENBERGII* (DE MAN, 1879)"

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Biology and Nutritional Profile of Freshwater Prawn *Macrobrachium rosenbergii* (De Man, 1879)

Brief Resume

Macrobrachium rosenbergii, also known as the giant river prawn or giant freshwater prawn, is a commercially important species of palaemonid freshwater prawn. It is found throughout the tropical and subtropical areas of the Indo-Pacific region, from India to Southeast Asia and Northern Australia. The giant freshwater prawn has also been introduced to parts of Africa, Thailand, China, Japan, New Zealand, the Americas, and the Caribbean. It is one of the biggest freshwater prawns in the world, and is widely cultivated in several countries for food.

Macrobrachium rosenbergii, the freshwater prawn has high market demand due to its nutritional value for human diet. Prawns are considered to be high range protein containing dietary substances. The present investigation aims to explore the biology and nutritional profile of the freshwater prawn, specifically focusing on its biological aspects of maturity, spawning, fecundity, length-weight relationships, morphometry and its nutritional composition of proximate composition, carbohydrate, protein, and fat content. This study will combine experimental fieldwork, laboratory analysis, and biochemistry to contribute to the understanding of the freshwater prawn's life cycle and nutritional value, which will have applications in aquaculture.

Introduction

M. rosenbergii can grow to a length over 30 cm (12 in). They are predominantly brownish in colour, but can vary. Smaller individuals may be greenish and display faint vertical stripes. The rostrum is very prominent and contains 11 to 14 dorsal teeth and 8 to 11 ventral teeth. The first pair of walking legs (pereiopods) is elongated and very thin, ending in delicate claws (chelipeds), which are used as feeding appendages. The second pair of walking legs are much larger and powerful, especially in males. The movable claws of the second pair of walking legs are distinctively covered in dense bristles (setae) that give them a velvety appearance. The colour of the claws in males varies according to their social dominance. Females can be distinguished from males by their wider abdomens and smaller second pereiopods. The genital openings are found on the body segments containing the fifth pereiopods and the third pereiopods in males and females, respectively.

The freshwater prawn *Macrobrachium rosenbergii,* a species native to tropical and subtropical regions, has emerged as a commercially valuable aquaculture species due to its rapid growth rate, high nutritional value, and adaptability to various environmental conditions. Freshwater prawns are rich in protein, essential fatty acids, vitamins, and minerals, making them a crucial food source in many parts of the world. Despite their economic importance, a limited understanding of the biology and nutritional composition of these prawns exists, particularly in relation to their growth dynamics, reproductive strategies, and biochemical properties.

This study seeks to fill this gap by investigating the prawn's biology and its nutritional profile, which will provide critical data for sustainable aquaculture practices and enhance the role of this species in the global food system.

Literature Review

1. **Biology of Freshwater Prawn**
    - *Maturity and Spawning*: Studies on the reproductive biology of *M. rosenbergii* suggests that environmental factors like water temperature, salinity, and photoperiod play a critical role in regulating sexual maturity and spawning. Female prawns are known to spawn multiple times in their lifespan, and their fecundity (the number of eggs they produce) varies with environmental conditions and nutritional factors.
    - *Fecundity*: Fecundity has been linked to prawn size, age, and nutritional status. Studies indicate that larger prawns tend to have higher fecundity, and this is particularly influenced by their feeding regime and environmental conditions during the breeding season.
    - *Length-Weight Relationship*: The relationship between prawn length and weight is used to assess the growth patterns and health of prawns in aquaculture settings. Several studies have shown that the relationship is exponential and may vary between populations depending on their environment and diet.
    - *Morphometry*: Morphometric parameters such as body length, carapace length, and body width are commonly used to determine the growth and health of prawns. These parameters can also provide insights into the ecological status of prawn populations.

2. **Nutritional Profile of Freshwater Prawn**
    - The proximate nutritional composition of *M. rosenbergii* includes high levels of protein: 20-25%, low fat, and moderate levels of carbohydrates, along with a significant amount of essential micronutrients. Variations in nutritional content occur based on diet, stage of maturity, and geographical location.
    - *Carbohydrates, Protein, and Fat*: Tissue biochemical analysis of these macronutrients shows a clear differentiation between the muscle, hepatopancreas, and exoskeleton. Protein content is highest in the muscle tissues, while fat is more concentrated in the hepatopancreas, which plays a central role in energy storage.

Objectives of Research

1. To investigate the reproductive biology of *Macrobrachium rosenbergii*, including its maturity, spawning patterns, fecundity, and environmental influences on these aspects.
2. To analyze the length-weight relationship and morphometric parameters as a means of assessing growth and health in freshwater prawn populations.
3. To determine the proximate nutritional composition of *M. rosenbergii* in relation to sex, focusing on protein, fat, carbohydrate, and micronutrient content.
4. To conduct biochemical tissue analysis of the male and female prawn to measure carbohydrate, protein, and fat concentrations across tissues (Gill, hepatopancreas, and brain).
5. Determination of Biochemical composition of haemolymph of *M. rosenbergii* in relation to sex.
6. To investigate the impact of environmental factors and diet on the biological and nutritional profile of the prawn.

Methodology

Study Area: Freshwater Prawns for the present study will be collected from Nanded Region.

1. **Field Collection and Sampling**
    - Freshwater prawns will be collected from different aquaculture farms and natural freshwater bodies of Nanded Region to represent a variety of environmental conditions. Samples will be categorized by size, age, and reproductive stage.

2. **Biological Analysis**
    - **Maturity and Spawning**: The reproductive stage of prawns will be assessed through histological examination of gonadal tissues and observation of spawning events in controlled environments. Fecundity will be calculated by counting eggs per spawning event.
    - **Length-Weight Relationship**: Measurements of prawn length (total body length and carapace length) and weight (wet weight) will be recorded to derive the length-weight relationship.
    - **Morphometric Analysis**: Morphometric parameters such as body length, carapace length, width, and body proportions will be taken using calipers and digital imaging software for accurate measurement.
3. **Nutritional Profiling**
    - **Proximate Composition**: The proximate composition (protein, fat, moisture, ash, and carbohydrates) will be determined using standard analytical methods.
    - **Tissue Biochemical Analysis**: Biochemical assays for protein, fat, and carbohydrates will be performed on Gill, hepatopancreas, and brain tissues.

Importance of Study

- **International Status**: As global demand for aquaculture products continues to grow, understanding the biology and nutritional composition of freshwater prawns will aid in optimizing production and improving the nutritional quality of farmed prawns, enhancing food security worldwide.
- **National Status**: Freshwater prawn farming is gaining significance in many countries with large aquaculture sectors, including India. This study will help improve sustainable farming practices and prawn health management within these regions.
- **Regional Status**: In Nanded of Marathwada region where *M. rosenbergii* is an essential part of local diets and economies, this study will provide critical insights for local aquaculture and food systems.
- **Scope of Study**: Variety of freshwater prawns (about 100 species) found all over the world of which 25 have inhabited the Indian waters. Among these, *Macrobrachium rosenbergii* (giant freshwater prawn is a crustacean species belonging to the family Palaemonidae) possessing high potential and great commercial importance in India and abroad. This study will have a direct impact on aquaculture practices, sustainability, and

the nutritional profile of prawns in aquaculture, benefiting stakeholders in the fishery sectors.

Proposed Work Plan and Tentative Chapter Scheme

Year 1:

- Collection of prawn samples from different aquaculture and natural environments.
- Initial biological analysis (maturity, spawning, fecundity).
- Morphometric analysis and length-weight relationship study.

Year 2:

- Completion of biological studies and extended sampling.
- Initiation of proximate composition analysis.
- Tissue biochemical analysis for carbohydrates, proteins, and fats.
- Compilation of data for preliminary analysis.

Year 3:

- Continued biochemical analysis and morphometric comparisons.
- Data analysis and formulation of conclusions.
- Writing of the research chapters, including the review of literature, objectives, and methodology.

Year 4:

- Final analysis and synthesis of results.
- Final writing and submission of dissertation.

Tentative Chapter Scheme:

1. **Introduction**
2. **Literature Review**
3. **Materials and Methods**
4. **Biology of Freshwater Prawn: Maturity, Spawning, and Fecundity**
5. **Nutritional Profiling of Freshwater Prawn**
6. **Tissue Biochemical Analysis**
7. **Results and Discussion**
8. **Summary**
9. **Conclusions and Recommendations**
10. **References**

Expected Outcomes

1. A comprehensive understanding of the reproductive biology and growth patterns of *M. rosenbergii*, which will inform aquaculture practices.
2. A detailed nutritional profile of freshwater prawns, including variations in protein, fat, and carbohydrate content.
3. Recommendations for optimizing prawn farming and improving prawn health and quality in aquaculture.
4. Contribution to the scientific literature on freshwater prawn biology and nutrition.

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